

COOPERATIVE GYPSY MOTH SURVEY PROGRAM IN MISSOURI TO PRESENT TIME

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Missouri has approximately 12.5 million acres of oak forest which could be severely damaged by a gypsy moth infestation. Even though gypsy moth feeds on many types of trees and shrubs, oak is one of its preferred hosts.

Extensive adult gypsy moth surveys have been conducted in Missouri since 1967 (Table 1).

A limited number of traps were placed in nearly every county of the state until 1981. From 1981 to 1984 approximately one-third of the counties were surveyed each year. From 1985 to 1995 at least one-half of the counties are trapped each year. From 1996 to 2005 at least 85% of counties were surveyed. Reduced funding across most agencies resulted in a rate of approximately 50% of counties being surveyed since 2006.

1974 - The first adult moth was taken six miles NW of Springfield, Missouri. No additional moths were taken from this area.

1980 - Adult moths were again found in Missouri. A total of three (3) moths were taken in the state. One was found in a trap at the KOA campground near Jonesburg in Montgomery County and two in St. Louis County. In St. Louis County one was taken in Clayton, one in West County at the junctions of Hwy. 109 and Hwy. 100 (A distance of approximately sixteen miles).

1981 - Nine (9) moths were taken in the state. Five were trapped in St. Louis County at four separate locations: one was trapped at the KOA campground near Jonesburg in Montgomery County; one at the junction of Hwy. 63 S. and I-70, in Columbia (Boone County); one at 51st St. and Wornall in Kansas City (Jackson County); and one at the I-44 rest stop, two miles SW of Joplin in Newton County. A total of 3,500 traps were placed in the state. Approximately one third of the counties surveyed.

1982 - Fourteen (14) moths were trapped; all in the St. Louis area. The moths were trapped in thirteen separate locations. A total of 4,200 traps were placed state wide. Approximately one third of the counties surveyed.

1983 - Eleven (11) moths were trapped in the state. Ten of these were at nine locations in St. Louis County. One was taken at High Ridge in Jefferson County. A total of 5,700 traps were placed in the state with 2,645 of this number being placed in St. Louis County. The area in St. Louis County where moths were caught previously was trapped at the rate of 16 traps per square mile. The remainder of the area was trapped at the rate of one trap per square mile. Approximately one third of the counties surveyed.

1984 - Thirteen (13) moths were taken in the state. Eleven of these were at ten locations in St. Louis County. One was taken in the NW area of Jefferson County near the adjoining county line. One was also taken near Fort Leonard Wood, Pulaski County. A total of 6,000 traps were placed in the state with 2,729 of this amount being in the St. Louis area.

1985 - Twenty-two (22) moths were taken in the state. Eighteen of these were at 15 locations in the St. Louis area. One was taken in NW Jefferson County; one at Gray Summit in Franklin County; one at Hannibal in Marion County; and one NE of Marshfield in Webster County. A total of 5,152 traps were placed in the state with 1,500 of this amount being in the St. Louis area.

1986 - Eight (8) moths were taken in the state. Seven of these were taken in St. Louis County, one in Johnson County. All were single trap finds. A total of 6,900 traps were placed in the state with 1,435 of this amount in the St. Louis area.

1987 - Five (5) moths were taken in the state, three of these in St. Louis County, one in Jefferson County, and one in Pike County. All were single trap finds. A total of 7,320 traps were placed in the state, with 1,180 of this amount being in St. Louis County. Eighty man-hours were spent in St. Louis County on egg mass survey (negative). The 1986 positive traps sites were delimited at 9 traps per square mile for 9 square miles.

1988 - Eleven (11) moths were taken in the state, five of these in St. Louis County in one trap, four in Webster County in one trap, one in Texas County, one in Jackson County. A total of 7,600 traps were placed within the state, with 900 of this amount being in St. Louis County. Eight man-hours were spent in St. Louis County on egg mass survey (negative). The 1987 positive trap sites were delimited at 9 traps per square mile for 9 square miles.

1989 - Eleven (11) adult male moths were captured within the state. Eight of these in the St. Louis metropolitan area in six traps; two in Webster County in one trap, and one in Callaway County. A total of 7,515 pheromone traps were placed in 86 counties throughout the state. The 1988 positive trap sites were delimited at 16 traps per square mile for 9 square miles.

1990 - Eight (8) adult male moths were captured within the state. Six of these were in St. Louis County and two in Crawford County. All were single trap catches. A total of 7,432 traps were placed in 61 counties throughout the state. All 1989 positive trap sites were delimited at 16 traps per square mile for 9 square miles. Approximately 50 man-hours were used for egg mass survey, with negative results.

1991 - Thirty-five (35) adult male moths were captured within the state. Twenty-four in St. Louis County (7 in one trap; 1 in St. Charles County; 5 in Jackson County; 3 in Buchanan County; 1 in Texas County and 1 in Christian County. A total of 6,819 traps were placed in 65 counties throughout the state. All eight of the 1990 positive catch sites were intensely surveyed at 9 traps per square mile within a nine square mile area around each positive trap site. Fourteen gypsy moths were caught in eight traps within this delimiting survey area.

1992 - Thirty-three (33) male moths were trapped during the 1992 gypsy moth survey. Fourteen in St. Louis County; seven in Texas County; three each in Stone and Buchanan counties; two each in Taney and St. Charles Counties; one in Greene and Newton Counties. A total of 8,721 traps were placed in 67 counties of the state. Two areas of concern in the state area as follows: Texas County on the north edge of Evening Shade, Missouri on the rural fire department property where six moths were trapped from one tree and another one approximately one mile away. The fire department had purchased a used fire truck in 1988 in the state of Vermont. The truck sat outside prior to purchase and may have been the origin of these moths. An infestation was discovered in NW Arkansas. Egg mass densities were estimated at 10,000 per acre.

1993 - A total of 9,032 traps were placed in 48 counties. Sixty-two (62) moths were trapped in 13 counties during this year's gypsy moth survey. The number of moths per county is as follows: Taney -28; St. Louis-11; Stone-7; Greene-3; Shannon-3; Jackson-2; Pulaski-2. The following counties had one moth each: Barry, Christian, Hickory, Jasper, Jefferson and Johnson. The 35 moths in Taney and Stone Counties are of real concern. This may be attributable to a larval blow out from the Compton, Arkansas infestation. Regardless of the source, it will take

several years of intensive survey. No moths were found in Texas County in Evening Shade, Missouri, where seven were taken in 1992.

Arkansas treated approximately 600 acres with Dimilin. Unfortunately, just before the scheduled treatment a strong storm (possibly a tornado) passed through the area and scattered larvae over a very wide area (likely including SW Missouri).

1994 - Forty moths (40) were taken in 35 traps in the state. Approximately 13,000 traps were set in 97 counties. Numbers were down in SW Missouri, only six moths were captured in Stone and Taney Counties, combined. The number of moths per county is as follows: Clay-2; Franklin-2; Jackson-3; Pettis-3; St. Louis-18; Stone-2; Taney-4. The following counties had one moth each: Christian, Jefferson, Phelps, Pulaski, Ripley, and Scotland. Five of the eighteen taken in St. Louis County were in 4 traps near Six Flags. A winter survey for egg masses in the area was negative. All catches were single moths except five traps, which had two each. Arkansas treated approximately 25,000 acres around Compton, Arkansas. A total of 286 moths were captured in Arkansas (90% reduction from 1993).

1995 - Twenty-six (26) moths were taken in 23 traps in the state. Approximately 12,500 traps were set in 85 counties. Sixteen of the moths were taken from 13 traps in St. Louis County. (Of the moths taken in St. Louis County, six moths were from a concentrated area north of Eureka.) Egg mass surveys in this area were negative. The only multiple trap catches were in St. Louis County. The number of moths per county is as follows: Christian-1; Jackson-1; Pettis-1; St. Louis County-16; Taney-4; Texas-3.

There was an accidental introduction of gypsy moth egg masses in eastern Dent County in 1995. An area of approximately 5 acres was treated twice with *Bacillus thuringiensis* var. *kurstaki* using ground application equipment in May. The area was heavily trapped as a follow-up measure and no moths were captured.

The risk rating classification of all counties in Missouri was re-evaluated by representatives from MDA, MDC, USDA-APHIS-PPQ, DNR, and USFS. Arkansas treated 17,697 acres twice with Bt. Only 14 moths were captured statewide in 11 traps. Arkansas plans no treatment in 1996, but will continue heavy trapping.

1996 - Six (6) moths were taken in six traps in the statewide survey in 1996**. Approximately 11,500 traps were set in 114 counties. This was the first time all 114 counties were surveyed in a single year, providing the most comprehensive survey to date in Missouri. All positives were single moth catches from the following counties: Christian, Holt, Taney (2 singles), and Texas Counties. The moth in Christian County was taken from a "delimiting" area, all others were taken in "detection" trapping. This total represents the lowest moth catch since 1987. **Note: an additional positive moth was discovered in 1997 in St. Louis County (Babler State park) in a trap from the 1996 survey, bringing total to 6 moths. The newly revised risk rating classification was utilized in the distribution of survey traps in 1996. Also new in 1996 was the use of GIS mapping technology to plot the location of traps and all positive moth sites. The Missouri Department of Conservation was instrumental in developing and implementing the mapping project. As part of the effort to standardize the survey program, newly developed _data sheets_ were used by all participating agencies to provide consistency in the recording of trap locations and positive finds. Another new project in 1996 was a newsletter, **Gypsy Moth News** A Report of Missouri Cooperative Gypsy Moth Program, developed to improve the communication between the various agencies, trappers, and other interested parties.

1997 - Thirteen (13) moths were taken in ten traps from two counties as follows: St. Louis County - 9 moths (5 singles, 2 doubles); Taney County in southwest Missouri - 4 moths (2 singles, 1 double). Note: an additional positive moth was discovered in St. Louis County in a trap

from the 1996 survey. Approximately 10,500 traps were deployed in this year's survey. Traps were placed in 108 of Missouri's 114 counties.

1998 - Seventeen (17) moths were taken in nine traps from seven counties as follows: St. Louis County - 9 moths (1 single, 1 with eight moths); Taney County - 2 moths (singles); St. Charles County - 2 moths (1 double); the following counties each reported one moth: Bollinger, Jackson, Johnson, and Platte Counties

Approximately 11,470 pheromone traps were placed throughout the state in the annual effort to detect the presence of this damaging insect pest. Traps were placed in approximately 108/114 counties. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, University of Missouri-IPM (coop agreement with USDA-APHIS-PPQ), with additional trapping conducted by, USDA-Vet. Services, and U.S. Department of Defense (Whiteman AFB, Ft. Leonard Wood).

1999 - Thirteen (13) moths were taken in twelve traps from five counties as follows: Clay County - 1 moth; Laclede County - 1 moth; St. Charles County - 4 moths (1 double, 2 singles); St. Louis County - 6 moths (all singles); and Taney County - 1 moth. Approximately 12,219 pheromone traps were utilized in this year's survey. Traps were placed in 108/114 counties throughout the state. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, University of Missouri-IPM (coop agreement with USDA-APHIS-PPQ), with additional trapping conducted by, USDA-Vet. Services, and U.S. Department of Defense (Whiteman AFB, Ft. Leonard Wood).

2000 - Twelve (12) moths were taken in ten traps from three counties as follows: St. Charles County - 2 moths (singles); St. Louis County - 9 moths (2 doubles, 5 singles); Stone County - 2 moths (singles). Approximately 12,130 traps were utilized in the survey. Traps were placed in 108/114 counties throughout the state. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, University of Missouri -IPM, USDA-APHIS-PPQ, and USDA-Veterinary Services, with additional trapping conducted by U. S. Department of Defense (Whiteman AFB, Ft. Leonard Wood) and Missouri National Guard.

2001 - Six (6) moths were taken in four traps from three counties as follows: Callaway County - 1 moth; St. Louis County - 4 moths (triple, single); Stone County - 1 moth. Approximately 11,889 traps were utilized in the survey. Traps were placed in 109/114 counties throughout the state. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, University of Missouri - IPM, USDA-APHIS-PPQ, and USDA-Veterinary Services, with additional trapping conducted by U.S. Department of Defense (Whiteman AFB, Ft. Leonard Wood) and the Missouri National Guard.

2002 - Four (4) moths were taken in four traps from two counties as follows: St. Charles - 1 moth; St. Louis County - 3 moths. Approximately 11,400 pheromone traps were utilized in the survey this year. Traps were placed in 102/114 counties throughout the state. Primary trapping agencies remain the Missouri Departments of Agriculture and Conservation, University of Missouri - IPM, USDA-APHIS-PPQ, and USDA-Veterinary Services, with additional trapping conducted by the U.S. Department of Defense (Whiteman AFB, Fort Leonard Wood) and the Missouri National Guard. The University of Missouri is withdrawing from participation in the annual survey after this season due to new program direction and support staff shortages.

2003 - A total of eleven (11) moths were reported from around the state. Moths were taken in eleven (11) positive traps from eight counties. Of the moths captured, four were from St. Louis

County (singles); one moth was captured in each of the following counties: Boone, Jasper, Lawrence, Platte, Pulaski, St. Charles, and Taney.

Approximately 11,400 pheromone traps were placed throughout the state in the annual effort to detect the presence of this damaging insect pest. Traps were placed in approximately 102/114 counties. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, USDA-APHIS-PPQ, with additional trapping conducted by U.S. Department of Defense (Whiteman AFB, Ft. Leonard Wood), and Missouri National Guard. Several areas of federal land (Mark Twain National Forest, George Washington Carver National Monument, and other federal monuments and wildlife areas) are included in the annual survey. The University of Missouri is no longer participating in the annual survey. State general revenue funding for the department of agriculture was cut during the spring of this year (affecting FY04 budget). The Missouri Department of Conservation has agreed to provide funds to make up the shortfall.

2004 – A total of eighteen (18) moths were reported from around the state. Moths were taken in sixteen (16) positive traps from seven counties. Of the moths captured, eight were from St. Louis Co. (singles); three from Taney County (double; single); two from Barry County (double); two from Jackson County (singles); and one moth was captured in each of the following counties: Boone, St. Charles, and Stone.

The overall results of the 2004 survey are consistent with recent surveys (Table 1), though the total number of moths taken in this year's survey is up from eleven taken in 2003. We were able to utilize GPS units to track trap locations through a grant from the National Wild Turkey Federation. The major activity continues to be found in the primary metropolitan areas of the state. Gypsy moth activity in some of our neighboring states to the north and east (particularly Illinois, Iowa, and Wisconsin) has increased in recent years and continues to be a primary concern. We should continue to monitor our situation in a manner consistent with our current approach. General revenue funding for the Missouri Department of Agriculture was cut for FY05; reducing the Personal Service Appropriation to \$42,413 and Expense and Equipment funding to \$2,158 (before Gov's withholding). Again, the Conservation Department has agreed to provide funding to make up shortfall (\$40,000)

2005 – A total of ten (10) moths were reported from around the state. Moths were taken in ten (10) positive traps from eight counties as follows (all single catches): Camden; Clay; Crawford; Greene; Jackson (2); Pettis (2); and Ste. Genevieve.

Results are consistent with recent trapping history, with the exception that no positives were taken from the St. Louis area (St. Louis City/County, St. Charles County, and Jefferson County) after nine positives in the St. Louis area in 2004. This is the first year with zero catches from the St. Louis area since 1979, 26 years ago! Every year since 1980, gypsy moth adults have been taken from the St. Louis area.

Approximately 11,000 traps were placed throughout the state (102/114 counties) in a cooperative effort between the Missouri Departments of Agriculture and Conservation and USDA-APHIS-PPQ. Additional traps are placed and monitored by U.S. Department of Defense (Ft. Leonard Wood, Whiteman AFB) and the Missouri National Guard. State general revenue funding for the Department of Agriculture gypsy moth program was cut again affecting FY06. Budget was cut to \$4,576 for Personal Service and \$0 for Expense and Equipment. Missouri Department of Conservation has not agreed to pick up shortfall (an additional \$50,000). *Note – fuel prices have hit \$2.99 per gallon at the time of this writing. (09/29/05)

2006 - Over 9,000 pheromone traps were placed in 61 of our 114 counties in our annual effort to detect the presence of gypsy moth. A total of 17 gypsy moths were found in the traps, a result that is consistent with past years. Thirteen of these were found in traps in the St. Louis area with

one suburb representing the most active area. This contrasts with 2005 when, for the first time in 25 years, no gypsy moths were found in the St. Louis traps. That result was certainly suspicious and our suspicions were later confirmed when we were notified after the season that those lures were indeed ineffective.

Trap density is determined by risk category (see map). The highest trap density (1 trap per square mile) is at the lake regions of Missouri because of the out-of-state visitors that frequent those areas and the St. Louis metro area. Other urban areas have the Category 1 density. The Category 2 area corresponds to the presence of our oak forests.

For a second year, all gypsy moths in the traps were submitted to Otis Lab to determine if Asian gypsy moths were present; none were found.

Primary trapping agencies were Missouri Departments of Agriculture and Conservation, and USDA-APHIS-PPQ. Military sites were trapped by the US Department of Defense and Missouri National Guard. Several areas of federal land (e.g., Mark Twain National Forest, some federal monuments and wildlife areas) were included in the annual survey.

2007 - A total of seven (7) moths were reported from around the state. Moths were taken in seven (7) positive traps from the following four (4) counties: Greene (1) - Southwest Missouri, near Springfield, Jackson (1) - Kansas City metro area, near a large retail chain's distribution center, St. Louis (4) - Various locations in the St. Louis metro area, Stone (1) - Southwest Missouri, near a large theme park.

Approximately 9,906 pheromone traps were placed around the state by all cooperators in the annual effort to detect the presence of this damaging insect pest. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, USDA-APHIS-PPQ, with additional trapping conducted by U.S. Department of Defense, Missouri National Guard and U.S. Fish and Wildlife.

All gypsy moths were submitted to the Otis Lab to determine if Asian gypsy moths were present, none were found.

2008 - A total of 10 moths were reported from around the state. Moths were taken in 10 positive traps from the following 6 counties: Franklin (2), Jackson (1), Ozark (1), St. Louis (4), Webster (1), Wright (1).

Approximately 11,794 pheromone traps were placed around the state (96 of 114 counties) by all cooperators. Primary trapping agencies were Missouri Departments of Agriculture and Conservation, USDA-APHIS-PPQ, with additional trapping conducted by U.S. Department of Defense, Missouri National Guard and U.S. Fish and Wildlife.

All gypsy moths were submitted to the Otis Lab to determine if Asian gypsy moths were present, none were found.

2009 – A total of 22 moths were reported from around the state. Moths were taken in 17 positive traps from the following 6 counties: Clay (4), Jackson (1), Polk (1), St. Charles (1), St. Louis (14), and Stone (1).

Approximately 9,731 pheromone traps were placed around the state (67 of 114 counties) by all cooperators in the annual effort to detect the presence of this damaging insect pest. Primary trapping agencies were Missouri Department of Agriculture, Missouri Department of

Conservation and USDA-APHIS-PPQ, with additional trapping conducted by U.S. Department of Defense, Missouri National Guard and U.S. Fish and Wildlife.

All gypsy moths were submitted to the Otis Lab to determine if Asian gypsy moths were present, none were found.

2010 - A total of 2 moths were reported from around the state. Moths were taken in 2 positive traps from the following 2 counties: Jasper: (1), Jefferson: (1). Both moths were forwarded to the USDA OTIS lab for molecular testing and were found not to be Asian gypsy moths.

Approximately 9,276 pheromone traps were placed around the state (71 of 114 counties) by all cooperators in the annual effort to detect the presence of this damaging insect pest. Primary trapping agencies were Missouri Department of Agriculture, Missouri Department of Conservation and USDA-APHIS-PPQ, with additional trapping conducted by U.S. Department of Defense, Missouri National Guard, U.S. Army Corps of Engineers and U.S. Fish and Wildlife.

2011 – A total of 4 moths were captured in this year's survey. Moths were captured in the following counties: Callaway (1), Jefferson (1), Lewis (1) and St. Louis (1). All moths were forwarded to the USDA OTIS lab for molecular testing and found not to be Asian gypsy moths.

Due to funding cuts, the Missouri Department of Agriculture did not participate in trapping this year. Funding was restored for FY2012 and late in 2011 MDA hired a Forest Pest Program Coordinator to manage the MDA gypsy moth and thousand cankers surveys, as well as manage other forest pest issues.

Participating agencies in the 2011 survey placed 6,024 pheromone traps in 60 of Missouri's 114 counties. Participating agencies were the Missouri Department of Conservation, USDA-APHIS-PPQ, Missouri National Guard, U.S. Army, and U.S. Army Corps of Engineers.

2012 – A total of 1 moth was captured in this year's survey in Cape Girardeau county. The specimen was forwarded to the USDA OTIS lab for molecular testing and was found not to be Asian gypsy moth.

A total of 6,804 pheromone traps were placed in this year's survey in 58 of Missouri's 114 counties. Participating agencies were Missouri Department of Agriculture, Missouri Department of Conservation, USDA-APHIS-PPQ, Missouri National Guard and U.S. Army.

2013 – A total of 5 moths were captured in this year's survey. Moths were captured in the following counties: Clay (1), Greene (1), Madison (1) and St. Louis (2). All were single-moth captures. All five moths were forwarded to the USDA OTIS lab for molecular testing and were found not to be Asian gypsy moth.

Approximately 6,741 pheromone traps were placed in 56 of Missouri's 114 counties. Participating agencies were Missouri Department of Agriculture, Missouri Department of Conservation, USDA-APHIS-PPQ, Missouri National Guard and U.S. Army.

Table 1. Historic Gypsy Moth Trapping Data in Missouri

	# Trans used in survey	Area surveyed	# Multiple catches	Total number of
1967-1973	??	Limited statewide	0	0
1974	??	Limited statewide	0	1
1976-1979	??	Limited statewide	0	0
1980	??	Limited statewide	0	3
1981	3,500	1/3 of state	1	9
1982	4,200	1/3 of state	1	14
1983	5,700	1/3 of state	1	11
1984	6,000	1/3 of state	1	13
1985	5,152	1/2 of state	2	22
1986	6,900	1/2 of state	0	8
1987	7,320	1/2 of state	0	5
1988	7,600	1/2 of state	2	11
1989	7,515	86/114 counties	2	11
1990	7,432	61/114 counties	0	8
1991	6,819	65/114 counties	3	35
1992	8,721	67/114 counties	7	33
1993	9,032	48/114 counties	7	62
1994	13,000	97/114 counties	5	40
1995	12,500	85/114 counties	2	26
1996**	11,500	114/114 counties	0	6
1997	10,500	108/114 counties	2	13
1998	10,500	108/114 counties	2	17
1999	12,200	99/114 counties	1	13
2000	11,000	100/114 counties	2	12
2001	12,000	109/114 counties	1	6
2002	11,400	102/114 counties	0	4
2003	11,508	102/114 counties	0	11
2004	11,500	102/114 counties	2	18
2005	11,500	102/114 counties	0	10
2006	9,150	61/114 counties	4	17
2007	9,906	80/114 counties	0	7
2008	11,794	96/114 counties	0	10
2009	9,731	67/114 counties	3	22
2010	9,276	71/114 counties	0	2
2011	6,024	60/114 counties	0	4
2012	6,807	58/114 counties	0	1
2013	6,741	56/114 counties	0	5
**All counties surveyed			Total moths taken in 46 years	490